

EXAMINER'S AMENDMENT

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment of claims 1, 6, 8, 13, 17, 18, 19, 21, 26, 31, and 34 was given in a telephone interview with Gregory Sebald on 2/17/2009. During the interview, the examiner indicated that the application was close to being in condition for allowance, except for 35 USC 112 second paragraph deficiencies that were discovered in the claims listed above. In the limitations present in the original independent claim 1, and the analogous limitations from claim 1 that were included in the amended dependent claims listed above, the examiner noticed the following deficiencies: On line 4 of claim 1, "quantization of the images" included the phrase "the images", which has insufficient antecedent basis. The examiner suggested this phrase being changed to "the digital images". Line 10 of claim 1 includes the limitations "the overall image", and the examiner suggested that this phrase be changed to "an overall image". The foregoing changes must also be made in the dependent claims listed above (that were treated in the first action), since limitations from the original claim 1 have been inserted into these depending claims. Also, amended claim 1 includes limitations that were originally included in the cancelled claim 2. Therefore, line 13 of amended claim 1 includes the limitations "the image", which must be changed to "each image of the digital images".

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Analogous changes must be made to the dependent claims listed above. That is, where appropriate limitations indicating a plurality of images must be changed to indicate a plurality of digital images, and limitations indicating a single image must be changed to indicate each image of the digital images.

The application claims has been amended as follows (note that ~~striktthrough~~ indicates cancelled limitations and underlining indicates added limitations):

1.(CURRENTLY AMENDED) Method of processing digital images comprising
one or more objects to be quantified, the method comprising the following main stages:
normalization of the digital images;
quantization of the digital images to one bit, further comprising at least one of the following stages:
calculating, from the images quantized to one bit, the perimeter, area or fractal dimension of the one or more objects to be quantified;
reconstructing, from the images quantized to one bit, a 3D-image of the one or more objects to be quantified, or
calculating, from the normalized images, the fractal dimension of ~~the~~ an overall image;
a stage of image's normalization (NORM) which comprises the following steps:
1)

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dividing ~~the image~~ each image of the digital images into quadrants;

2)

calculating the mean value of intensity of the pixels belonging to each quadrant;

3)

calculating the mean value of intensity for all the quadrants as a mean of the calculated means of step 2);

4)

setting for each quadrant the mean value of intensity calculated according to step 3) by performing one of adding or subtracting a same intensity value to each pixel inside a quadrant in order to maintain original delta_intensity among the pixels inside a same quadrant;

reiterating steps 1) to 4) up to a preset quadrant side length.

6.(CURRENTLY AMENDED) Method of processing digital images

comprising one or more objects to be quantified, the method comprising the following main stages:

normalization of the digital images;

quantization of the digital images to one bit, further comprising at least one of the following stages:

calculating, from the images quantized to one bit, the perimeter, area or fractal dimension of the one or more objects to be quantified;

reconstructing, from the images quantized to one bit, a 3D-image of the one or

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more objects to be quantified, or

calculating, from the normalized images, the fractal dimension of ~~the~~ an overall image;

1 a) dividing ~~the image~~ each image of the digital images into four quadrants;

2a) calculating the mean value of intensity of the pixels belonging to each quadrant;

3a) calculating the mean value of intensity for the four quadrants as a mean of the

four calculated means of step 2a);

4a) setting for each quadrant the mean value of intensity calculated according to step 3a) by performing one of adding or subtracting a same intensity value to each pixel inside a quadrant in order to maintain original delta_intensity among the pixels inside a same quadrant;

5a) determining for each quadrant the max and the min values of intensity of the pixels and calculating for each pixel an extended intensity value (EI) which derives from the stretching of the digital values inside the range of the possible digital values;

6a) setting for each pixel the Elpixel calculated according to step 5a);

7a) reiterating steps 1 a) to 6a) up to a preset quadrant side length.

8.(CURRENTLY AMENDED) Method of processing digital

images comprising one or more objects to be quantified, the method comprising the following main stages:

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normalization of the digital images;

quantization of the digital images to one bit, further comprising at least one of the following stages:

calculating, from the images quantized to one bit, the perimeter, area or fractal dimension of the one or more objects to be quantified;

reconstructing, from the images quantized to one bit, a 3D-image of the one or more objects to be quantified, or

calculating, from the normalized images, the fractal dimension of ~~the~~ an overall image;

wherein the normalization stage comprises:

1b) dividing ~~the image~~ each image of the digital images into quadrants;

2b) determining for each quadrant the max and the min values of intensity of the pixels and calculating for each pixel an extended intensity value (EI) which derives from the stretching of the digital values inside the range of the possible digital values;

3b) storing the Elpixel value for each pixel of each quadrant in a data structure;

4b) reiterating steps 1b) to 3b) up to a preset quadrant side length in order to obtain for each pixel a set of intensity values in the data structure;

5b) calculating for each pixel the mean of the intensity values of the set stored in the data structure and setting the calculated mean value to the respective pixel.

13. (CURRENTLY AMENDED) Method of processing digital images

comprising one or more objects to be quantified, the method comprising the

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following main stages:

normalization of the digital images;

quantization of the digital images to one bit, further comprising at least one of the following stages:

calculating, from the images quantized to one bit, the perimeter, area or fractal dimension of the one or more objects to be quantified;

reconstructing, from the images quantized to one bit, a 3D-image of the one or more objects to be quantified, or

calculating, from the normalized images, the fractal dimension of ~~the~~ an overall image;

a stage of object's sorting (SORT) for identifying objects made up from 4-connected pixels, which includes the following steps:

1d) scanning of ~~the image~~ each image of the digital images quantized to "1 bit" along a predefined direction on an x, y axis system;

2d) selecting a first active pixel along said direction of scanning, said active pixel being identified by a first set of x, y values, said first active pixel belonging to a first object's image;

3d) performing on said first selected active pixel a search routine in the positions next to said selected pixel on a line of said direction;

4d) iterating step 3d) until an inactive pixel is found;

5d) assigning to each active pixel selected according to steps 3d) and 4d) a set of x, y values, saving them in the storing means of the processing system (7) and switching said pixels from active to inactive in the object's image;

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6d) evaluating for each pixel selected according to steps 3d), 4d) and 5d) the two next pixels in the direction orthogonal to the scanning direction and selecting the active pixels;

7d) performing, for each of said active pixels selected according to step 6d), the routine of steps 3d) to 5d);

8d) iterating steps 6d) and 7d) until all of the connected pixels belonging to the same object have been saved;

9d) repeating steps 1d) and 2d) until a first active pixel of a further object's image is found;

10d) repeating steps 3d) to 9d) until ~~the whole image has~~ all digital images have been scanned.

17. (CURRENTLY AMENDED) Method of processing digital images

comprising one or more objects to be quantified, the method comprising the following main stages:

normalization of the digital images;

quantization of the digital images to one bit, further comprising at least one of the following stages:

calculating, from the images quantized to one bit, the perimeter, area or fractal dimension of the one or more objects to be quantified;

reconstructing, from the images quantized to one bit, a 3D-image of the one or more objects to be quantified, or

calculating, from the normalized images, the fractal dimension of the an overall

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image;

calculating a parameter (w) indicating the degree of "rugosity" of the selected object, the (w) parameter being preferably calculated by means of the following algorithm:

$w = [\text{Refer to the amended claims dated 01/05/2009}]$

wherein P_f is the perimeter, A_f is the area of the object and R is the "roundness coefficient" of the object; wherein R is on its turn calculated with the following algorithm

$R = [\text{Refer to the amended claims dated 01/05/2009}]$

wherein P_e is the perimeter of the ellipse in which the measured object is inscribed and A_e its area.

18. (CURRENTLY AMENDED) Method of processing digital images comprising one or more objects to be quantified, the method comprising the following main stages:

normalization of the digital images;

quantization of the digital images to one bit, further comprising at least one of the following stages:

calculating, from the images quantized to one bit, the perimeter, area or fractal dimension of the one or more objects to be quantified;

reconstructing, from the images quantized to one bit, a 3D-image of the one or more objects to be quantified, or

calculating, from the normalized images, the fractal dimension of the an overall

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image;

a stage of dimensional calculation (DIM-CLC) for calculating the fractal dimensions of perimeter and area of the observed objects, wherein said fractal dimension of the perimeter (D_p) and said fractal dimension of the area (DA) are determined according to the following steps:

dividing ~~the image~~ each image of the digital images of the object into a plurality of grids of boxes having a side length s , in which s varies from a first value substantially corresponding to the side of the box in which said object is inscribed and a predefined value which is a fraction of said first value,

calculating a value of a logarithmic function of $N(e)$, in which $N(e)$ is the number of boxes necessary to completely cover the perimeter (P) or the area (A), respectively, of the object and of a logarithmic function of $1/e$ for each e value of step a), thus obtaining a first set of values for said logarithmic function of $N(e)$ and a second set of values for said logarithmic function of $1/e$,
calculating the fractal dimensions (D_e) or (DA) as the slope of the straight line interpolating said first set of values for said logarithmic function of $N(e)$ for the perimeter (P) or the area (A), respectively, versus said second set of values of step b).

19. (CURRENTLY AMENDED) Method of processing digital images comprising one or more objects to be quantified, the method comprising the following main stages:

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normalization of the digital images;

quantization of the digital images to one bit, further comprising at least one of the following stages:

calculating, from the images quantized to one bit, the perimeter, area or fractal dimension of the one or more objects to be quantified;

reconstructing, from the images quantized to one bit, a 3D-image of the one or more objects to be quantified, or

calculating, from the normalized images, the fractal dimension of ~~the~~ an overall image;

a stage of surface quantification (S-QUANT) performed on ~~the image~~ each image of the digital images normalized according to the NORM stage, the stage comprising the following steps:

1f)

dividing the image in a x, y bidimensional mesh with n x n boxes of side l;

2f)

dividing the 0-256 grey scale into n subregions having each a $256/n$ value;

3f) calculating for each box of the x, y bidimensional mesh the min and max value of the pixels contained therein and of the pixels that contour the box;

4f) calculating how many subregions of $256/n$ value are included between the min and max values of the pixels of each box;

5f) calculating the number $N(1)$ of tridimensional boxes of side 1 that intercepts the image's surface as a sum of the subregions of all the boxes calculated

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according to step 40;

6f) reiterating steps 1f) to 50 with a side length 1' less than 1;

7f) by repeating step 6f), generating a first set of values of a logarithmic function of $1/1$ and a second set of values of a logarithmic function of $N(1)$;

8f) calculating the fractal dimension of ~~the~~ each image's surface as the slope of the straight line interpolating said first set of values versus said second set of values of step 7f).

21. (CURRENTLY AMENDED) Method of processing digital images

comprising one or more objects to be quantified, the method comprising the following main stages:

normalization of the digital images;

quantization of the digital images to one bit, further comprising at least one of the following stages:

calculating, from the images quantized to one bit, the perimeter, area or fractal dimension of the one or more objects to be quantified;

reconstructing, from the images quantized to one bit, a 3D-image of the one or more objects to be quantified, or

calculating, from the normalized images, the fractal dimension of ~~the~~ an overall image;

a stage of 3D-reconstruction (3D-R) performed on ~~the image~~ each image of the digital images subjected to the IMA-EL stage, the 3D-R stage comprising the following steps:

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1g) overlapping each image with the subsequent image along the z axis;

2g) minimizing the difference of brightness or colour intensity between overlapping pixels by shifting along the x axis or the y axis an image with respect to each other;

3g) repeating steps 1 g) and 2g) for each pair of adjacent images;

a stage of object counting (O-COUNT), which comprises the following steps:

1h) scanning of the 3D-image quantized to "1 bit" along a predefined direction on an x, y axis system;

2h) selecting a first active pixel along said direction of scanning, said active pixel being identified by a first set of x, y values, said first active pixel belonging to a first object's image;

3h) performing on said first selected active pixel a search routine in the positions next to said selected pixel on the direction's line;

4h) iterating step 3h) until an inactive pixel is found;

5h) assigning to each active pixel selected according to such steps 3h) and 4h) a set of x, y values, saving them in the storing means of the processing system 7 (all of such pixels will have the same y value and x values in progressive order) and switching said pixels from active to inactive in the object's image;

6h) evaluating for each pixel selected according to steps 3h), 4h) and 5h) the two next pixels in the coplanar direction orthogonal to the scanning direction and the two next pixels along the z axis, in the directions +z and -z, and selecting the active pixels;

7h) performing, for each of said active pixels selected according to step 6h), the

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routine of steps 3h) to 5h);

8h) iterating steps 6h) and 7h) until all of the connected pixels belonging to the same object have been saved;

9h) repeating steps 1h) and 2h) until a first active pixel of a further object's image is found;

10h) repeating steps 3h) to 9h) until ~~the whole image has~~ all digital images have been scanned;

11h) counting of the number of the objects sorted according to steps 1h) to 10h).

26. (CURRENTLY AMENDED) Method of processing digital images

comprising one or more objects to be quantified, the method comprising the following main stages:

normalization of the digital images;

quantization of the digital images to one bit, further comprising at least one of the following stages:

calculating, from the images quantized to one bit, the perimeter, area or fractal dimension of the one or more objects to be quantified;

reconstructing, from the images quantized to one bit, a 3D-image of the one or more objects to be quantified, or

calculating, from the normalized images, the fractal dimension of the an overall image;

a stage of volume calculation (V-CLC) which comprises the following steps:

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li) calculating the area of each object in a first 2D-image corresponding to a first object's section;

2i) multiplying the area calculated according to step li) by a distance between the first section's image and the subsequent section's image, taken in the z direction of scanning, wherein an image of the same object is contained;

3i) reiterating steps li) and 2i) for each section's image in the order;

wherein the volume is calculated as:

$v = [\text{Refer to the amended claims dated 01/05/2009}]$

wherein d is the distance between the two sections, A is the area of the first object's section and a is the area of the second object's section.

31. (NEW) Method according to claim 1, comprising reconstructing, from the digital images

quantized to one bit, a 3D-image of the one or more objects to be quantified, and calculating, from the normalized images, the fractal dimension of the overall image.

34. (NEW) Method according to claim 1, comprising calculating, from the digital images

quantized to one bit, the perimeter, area and fractal dimension of the one or more objects to be quantified.

Allowable Subject Matter

The following is an examiner's statement of reasons for allowance: The cited art and prior art in general does not include the details set fourth in the original claim 2 that have been added to the amended independent claim 1. The detailed steps are sufficiently specific as to be unique to the instant application. All other claims depend from the amended independent claim 1. These steps are not obvious in light of the prior art.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Atiba Fitzpatrick whose telephone number is (571) 270-5255. The examiner can normally be reached on M-F 10:00am-6pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Samir Ahmed can be reached on (571)272-7413. The fax phone number for Atiba Fitzpatrick is (571) 270-6255.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for

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published applications may be obtained from either Private PAIR or Public PAIR.

Status information for unpublished applications is available through Private PAIR

only. For more information about the PAIR system, see [http://pair-](http://pair-direct.uspto.gov)

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9199 (IN USA OR CANADA) or 571-272-1000.

Atiba Fitzpatrick

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